

KOMATSU

P&H

Centurion Shovel Control System Product Overview





Raising the Bar on Productivity

Your mine operation thrives on efficiency. Toward that objective, optimizing the performance of your P&H electric shovel is especially important.

The Centurion electrical control system upgrades help make that happen while positioning your mine for more productivity gains well into the future by providing your shovel with a multi-generational control system platform developed with a total systems approach within shovel design limits.

This assures smooth, synchronous control of all motions, raising the bar on safety, reliability and productivity.

Komatsu engineers launched the Centurion electrical control system in 2004 with a systems approach to product development. This approach assures the performance is matched with the over all shovel design in mind. This maximizes performance, but not at the expense of the structural design life; assuring the lowest cost per ton when compared to competitive drive systems.

With an operational installed base of over 300 shovels globally, the Centurion electrical control system demonstrates a proven track record and is the drive system of choice. 90% of all P&H electric mining shovels with digital drive systems operating globally have the Centurion electrical control system.

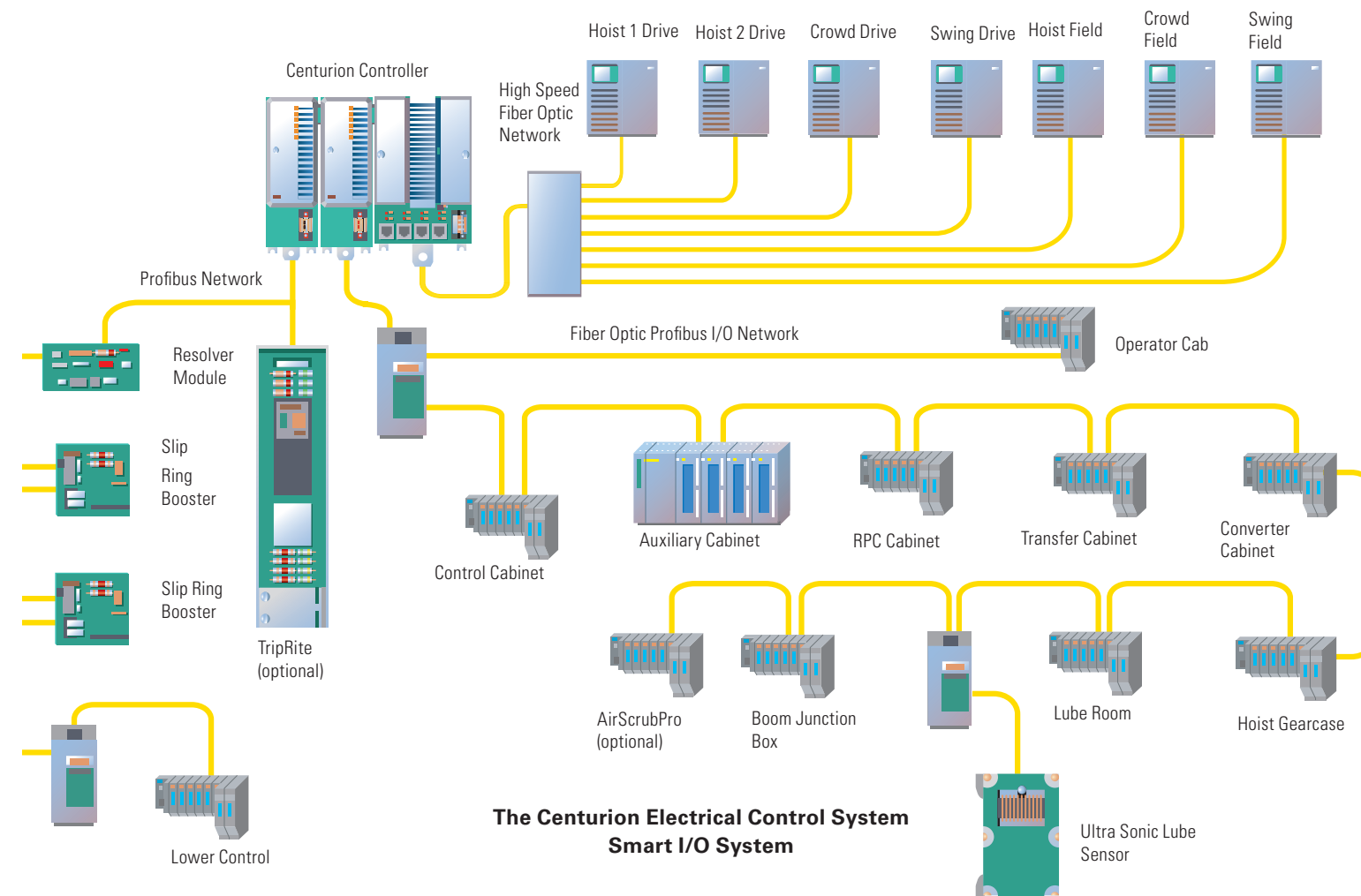
The latest advancements to the Centurion electrical control system include optimization of drive control, enhanced systems such as RPC, I/O and data management tools. Our continuous improvement approach to product development assures you will always be in the driver's seat when it comes to the latest advancements in safe operation, reliability and productivity.

Our Centurion electrical control system objective is simple: To equip your shovel with a multi-generational platform for technology development with a systems approach that increases performance – within the design limits of your shovel.

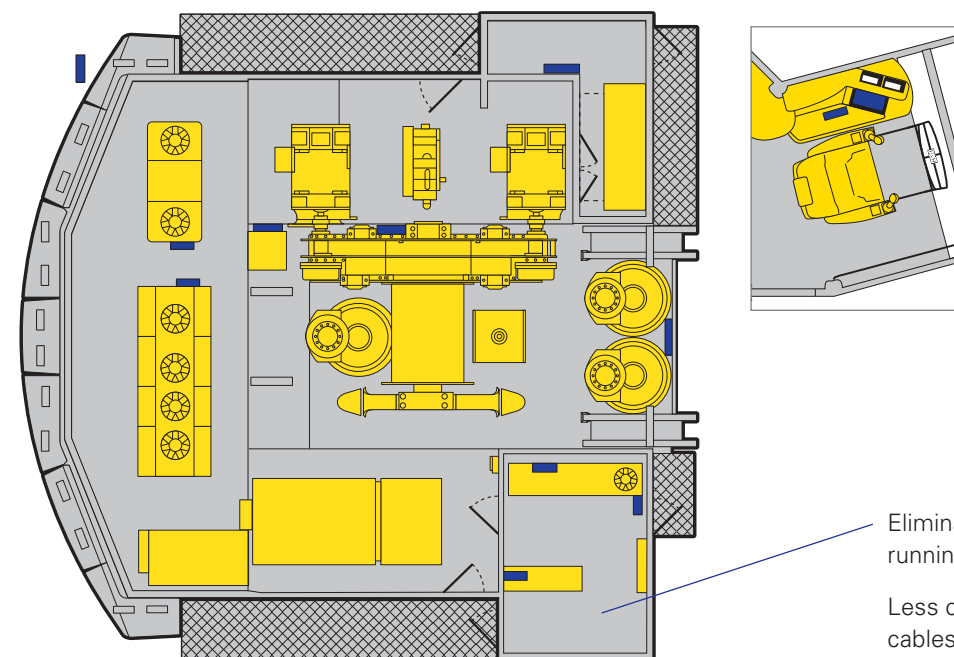
Here is what you obtain by investing in a Centurion control system upgrade:

- Advanced controls with user friendly Interface
- Reduced cabling and wiring over analog system
- Retrofittable to analog system
- Increased performance over analog system
- Improved diagnostics
- Advanced safeguards
- Cycle state engine
- Reduced spare parts over analog system
- Commonality of parts
- Software standardization
- Increased reliability and productivity

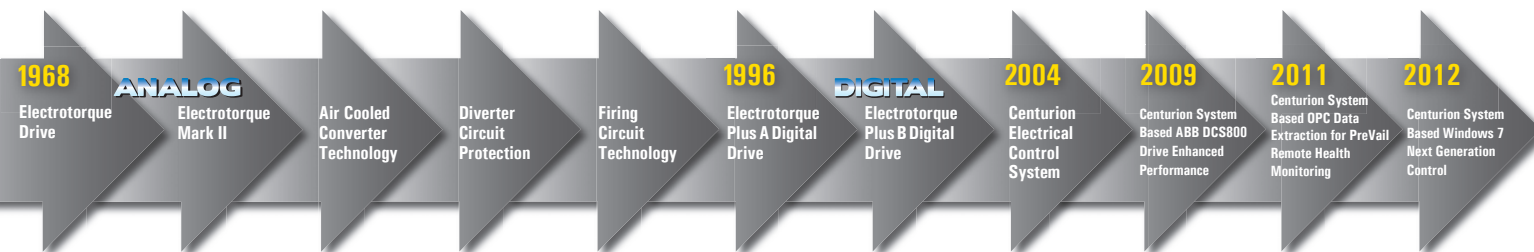
The Centurion Electrical Control System Drive Network



The Centurion Electrical Control System Smart I/O System



Eliminates the majority of wiring presently running up to the Control and Auxiliary Cabinets.
Less cabling = less potential for damaged cables resulting in grounds.



Forward Looking, Backward Compatible

As a natural progression from the Electrotorque and Electrotorque Plus control systems, the Centurion electrical control system epitomizes Komatsu's ongoing commitment to advanced technologies. As a platform for future technologies, the Centurion electrical control system is also available as a retrofit for many P&H shovels.

The Centurion Electrical Control System Standard Features

Standard Features	Centurion Electrical Control System	Competitive Drive System F	Competitive Drive System A
DC Digital Drive Replaces obsolete analog drive system with digital drives	✓	✓	✓
Extended Speed Range Increased motor speed over analog system	✓	✓	✓
Dynamic Field Weakening Dynamic variable speed and torque	✓	✓	✓
Advanced Control Loop Safeguard with Load Calculator Improved control of fully loaded dipper throughout the load cycle	✓		
OPC Compliant GUI Improved method of data extraction	✓	✓	
Test Modes with Motivator Mode Reduces troubleshooting time and reduced setup time to motivate shovel	✓		
Automatic Boom Soft Setdown Reduces structural damage to pennant lines and boom during stage 2 boom jacking	✓		
Opti-Dig Prevents unproductive stalling in the bank reducing motor thermal overload	✓		
Soft Line Detection Monitors drive power optimizing controls during soft line detection	✓		
RPC Bank Rotation Rotates RPC banks reducing the thermal loading on any one RPC bank	✓	✓	
Cycle State Engine Measures and reports cycle time in real-time (Dig T, Swing T, Tuck T)	✓		
Remote Hoist Pendant Remote operation of Hoist drum during rope changes with improved control and line of site	✓		

The Centurion Electrical Control System Technology Options

Options Available	Centurion Electrical Control System	Competitive Drive System F	Competitive Drive System A
Payload System with Cycle State Engine Dipper and haulage payload reported with cycle time for optimized loading	✓	✓	
Universal Dispatch Interface Dispatch Interface sharing data between dispatch system and shovel control system for optimized loading	✓	✓	
Motor Upgrades Motor upgrades available for increased thermal capabilities	✓	✓	
Advanced Power Monitoring Provides power monitoring information made available in the GUI screen and is transferred to PreVail Remote Health Management system.	✓	✓	
RPC Advanced Diagnostics Diagnostic testing system for troubleshooting and optimizing the RPC system	✓	✓	
Remote Health Monitoring The PreVail Remote Health Management system leverages state of the art technologies and capabilities unmatched in the industry for optimizing monitoring reliability and productivity of your shovel fleet.	✓		
ARC Flash Detection Incorporates ARC flash protection to electrical cabinets	✓		
Vibration Monitoring Online vibration monitoring system integrated with PreVail Remote Health Management	✓		
Track Shield Dipper to crawler collision detection and avoidance system reducing the frequency and severity of impacts	✓		
TripRite Dipper trip system with brushless DC motor and optimized control trips door every time	✓		

Significant Improvements with the Centurion Electrical Control System

- **Haulage Load Time**
10% to 15% improvement in load time **
 - **Effective Dig Rate**
10% to 15% improvement in dig rate **
 - **Motor Performance**
10% average increase in motor speed across all motions **
 - **Average Cycle Time**
1.5 to 3 seconds reduction in average cycle time **
 - **Electrical Availability**
1% to 3% increase in electrical availability **
 - **Circuit Board Parts Inventory**
70% reduction in circuit board support parts **
 - **Return on Investment**
Payback generally ranges from 1 to 3 years depending on site specific variables
- ** Results are based on comparative data when converting analog Electrotorque series shovel to a Centurion electrical control system. Actual results may vary based on application based variables



Our multi-generational and life cycle approach to Centurion electrical control system planning and development reduces your operating and maintenance costs – both in the short- and long-term.

The Centurion electrical control system features inherently help you cut maintenance, troubleshooting and repair time through greater efficiency, reliability and major technology improvements. Here are examples of what you obtain from the Centurion electrical control system:

- Industry standard device architecture
- Downloadable software stored in on-board libraries
- Self-testing diagnostics and error checking
- Advanced systems monitoring with PreVail Remote Health Management
- Independent GUIs in operator coop and machine house

And more is on the way. The Centurion electrical control system allows Komatsu to deliver new improvement opportunities in the shortest time frame consistent with the scale and nature of the development.

We provide you with a full complement of training methods from web-based eLearning to optional hands-on, instructor-led training. The Centurion electrical control system on-site training aids help you minimize shovel downtime associated with knowledge transfer.

All this is designed to reduce your cost per ton, with the full support of Komatsu service support, the largest, most capable field organization in the business. For maintenance, planning, OEM parts, upgrades, training and more, Komatsu is ready to serve your needs.



Komatsu Mining Corp. Group

mining.komatsu



Product designs, specifications and/or data in this document are provided for informational purposes only and are not warranties of any kind. Product designs and/or specifications may be changed at any time without notice. The only warranties that apply to sales of products and services are Komatsu's standard written warranties, which will be furnished upon request.

Komatsu, Joy, Montabert, P&H, AirScrubPro, Centurion, Electrotorque, Electrotorque Plus, Opti-Dig, PreVail, Track Shield, TripRite and other trademarks and service marks used herein are the property of Komatsu Ltd., Komatsu Mining Corp., or their respective owners or licensees.

© 2019 Komatsu Mining Corp. All rights reserved.